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Minerals Health and Safety Contract Research, Development, and Demonstration in Fiscal Year 1981

By Staff, Division of Minerals Health and Safety Technology

UNITED STATES DEPARTMENT OF THE INTERIOR

Information Circular 8839

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UNITED STATES DEPARTMENT OF THE INTERIOR
James G. Watt, Secretary
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MINERALS HEALTH AND SAFETY CONTRACT RESEARCH, DEVELOPMENT, AND DEMONSTRATION IN FISCAL YEAR 1981

by

Staff, Division of Minerals Health and Safety Technology

ABSTRACT

This publication summarizes, for potential contractors and other interested parties, the research, development, and demonstration contract projects programed by the Bureau of Mines for fiscal year 1982 (October 1, 1980 -September 30, 1981) under its Minerals Health and Safety Technology program. Contingencies may require that a significant portion of the program be deferred into fiscal year 1983. The objective of these projects is to provide an ordered and sequenced series of advances toward the Bureau's overall goal of providing the systems technology required to create a healthier and safer working environment for the Nation's mining and minerals processing workers.

INTRODUCTION

It is the policy of the Bureau of Mines to utilize as fully as possible the capabilities of the private sector in minerals research, and to that end this paper outlines the Bureau's current projected contract research needs.

It is important to realize that since this is a summary document, the project descriptions related to a design, fabrication, and demonstration effort do not necessarily imply total package procurement. The projects presented here represent the plans conceived at the beginning of the fiscal year and are subject to change based on emerging priorities and the availability of funds. A companion publication, Information Circular 8840, lists in-house projects.

Contracts for the Minerals Health and Safety Research program will be conducted in strict accordance with Federal Procurement Regulations. Availability of requests for proposals (RFP's) will be formally advertised in the Commerce Business Daily. No additional information will be supplied on these projects until after the RFP's are made available and then only in strict accordance with prescribed procedures. This document is not intended to solicit proposals from the contracting community. All unsolicited proposals (USP's) whose content reflects the objective(s) of proposed projects listed herein will be returned without formal review.

PROGRAM OUTLINE

The objective of the Minerals Health and Safety Technology program is to protect the health and safety of mining and minerals processing workers while insuring that newly developed technology incorporates health and safety criteria. In achieving this objective, four fundamental and complementary requirements must be considered by the research program, as follows:

1. Contributing to the viability of a basic industry.
2. Sustaining productivity.
3. Allowing for a return on capital investment.
4. Providing material and energy to the public.

Since mining and minerals processing involves a highly integrated and interrelated set of functions, the program has been divided into a set of interrelated subprograms, each with goals that will provide systems technology solutions to the problems within the framework of these fundamental requirements. The Minerals Health and Safety Technology program is divided into 12 subprogram areas as shown:

Health	Safety
Respirable Dust	Fire and Explosion Prevention
Radiation Hazards	Methane Control
Noise Control	Ground Control
Industrial Hygiene	Industrial Hazards
Ventilation	Post Disaster
	Explosives
	Systems Engineering

The objectives of these subprograms are described in the following pages, followed by the planned projects and their corresponding descriptions. It is not possible to give exact dollar estimates by sub-program area for competitive reasons, but the aggregate value of the anticipated contracts is approximately $37 million.

HEALTH

Respirable Dust

Program Objectives: To develop procedures for controlling the respirable mine dusts that still constitute the severest health problem facing the mining and minerals processing industries. To develop and/or improve techniques and equipment to prevent formation of hazardous dust concentration, and to protect miners against dusty atmospheres.

Control of Dust Formation

1. In-Mine Testing of the BOM's Low-RPM, Deep-Cutting Continuous Mining Machine

Objective: To determine specific forces and their magnitude encountered during mining of coal with an instrumented, deep-cutting, continuous mining machine. This information shall be made available to the mining equipment industry to design and construct production versions of the low-RPM, deep-cutting continuous mining machine. This is a continuation of an ongoing effort.

Control of Generated Dust

2. Optimizing Water Sprays for Dust Control on Longwall Shearer Faces

Objective: To test and evaluate water spray systems on longwall faces. To compare optimized water spray system with conventional system formerly in use at a full-scale model longwall face. The optimized system shall be tested in at least five mines. This is a continuation of an ongoing effort.

3. Mine Demonstrations of Longwall Dust Control Techniques

Objective: To evaluate the effectiveness of available dust control technology for double-drum shearer longwall sections in a coordinated, systematic program at a few longwall test sections, and to make the results available to the entire coal mining industry. This is a new RFP.

Dust Instrumentation and Measurement

4. Field Prototype Light-Scattering Machine-Mounted Respirable Dust Monitor

Objective: To develop a reliable device that can be mounted in the vicinity of a mining machine operator that will give the operator a visual signal of the immediate environmental dust level. This is a continuation of an ongoing effort.

5. Evaluation of Dust-Measuring Instruments

Objective: To conduct a laboratory evaluation of selected dust measurement instruments, both prototype and those commercially available, to determine precision and accuracy for representative mine aerosols, and to develop calibration procedures for each instrument. This is a continuation of an ongoing effort.

6. Personal Dust Exposure Monitor

Objective: To develop a reliable, sufficiently accurate personal exposure monitor for respirable coal mine dusts. The device shall provide the wearer with a warning when corrective actions are necessay. It shall be of suitable size, weight, and accuracy so that it can replace the personal dust sampler. This is a continuation of an ongoing effort.

Radiation Hazards

Program Objectives: To develop and provide new and improved radiation instrumentation, measurement, and control technology for protection of miners from exposure to radon and radon daughters and other nuclear radiation hazards in uranium and other mines.

Radiation Instrumentation and Measurement

1. Passive Nuclear Track Dosimeter

Objective: To continue modifications of existing dosimeter design to reflect improvements suggested by in-mine tests. To investigate new designs and concepts to reduce maintenance and contamination of external detector in active mine environments. To conduct verification testing in the laboratory and in the Twilight Mine and active mines. This is a continuation of an ongoing effort.

Noise Control

Program Objectives: To identify noise sources in underground and surface mines and in related mineral processing surface facilities, to abate these noise sources through both field retrofit and factory redesign approaches so that the mining operations and minerals processing activities meet the Federal noise exposure standards, to provide more accurate measurement and instrumentation of the noise environment, and to provide industry with the technical knowledge necessary to select, design, and implement noise control measures.

1. Investigation and Control of Noise Generated During Coal Cutting

Objective: To develop practical methods of abating the airborne noise generated by the cutting and extraction of coal by current and next-generation mining machines. The airborne noise generated during cutting and extraction shall be investigated by laboratory experimental techniques as well as by actual insitu test. A generalized noise prediction model shall be developed to identify and evaluate noise control modifications and redesigns for cutting and extraction devices. Hardware shall be developed to determine the effectiveness of the changes. This is a continuation of an ongoing effort that has completed the laboratory testing phase.

2. Flammability Criteria for Noise Control Products Used in Underground Mines and in Confined Areas of Mineral Processing Plants

Objective: To develop practical and safe flammability criteria and guidelines for the use of acoustic materials in the minerals industry. Using flammability and acoustic application information developed previously, an overall hazard potential shall be determined. This is a continuation of an ongoing effort.

3. Noise Study of Longwall Mining Systems

Objective: To develop quieter longwall mining equipment. The noise problems of longwall systems shall be identified, and feasible engineering controls that achieve quieter operation without affecting production shall be assessed and demonstrated. It is anticipated that the demonstration phase will involve a cooperative effort with a longwall equipment manufacturer. The identification and assessment phases were completed in FY80. This is a continuation of an ongoing effort.

4. Current Levels of Whole-Body Vibrations in Mines

Objective: To determine and assess the present levels of mine personnel exposure to whole-body vibrations and to compare these levels with the results of a medical literature search relating vibration parameters to physiological effects. This study represents the initial background effort in the possible establishment of a program in this area. This is a continuation of an ongoing effort.

5. Abatement of Taconite Plant Noise Sources

Objective: To develop and demonstrate practical engineering noise controls for equipment used in taconite plants. Prior work in this area determined the noise sources in taconite plants and concentrated on secondary crushers. This effort shall be aimed at quieting screens, rodmills, autogenous and semiautogenous mills, pneumatic rappers, and vacuum disk filters. Solutions developed shall be implemented in selected plants and evaluated to assess acoustic effectiveness, durability, and costs. This is a continuation of an ongoing effort.

6. Retrofit of Underground Load-Haul-Dump Machines With Noise Control Packages

Objective: To develop retrofit noise control technology for specific models of LHD machines. Noise control techniques shall be implemented and in-mine tested. Participation of the contractor with equipment manufacturers and mine operators is considered essential in conducting this contract. This contract is a continuation of ongoing efforts to quiet LHD's through retrofit means.

7. Vibrating-Screen Noise Abatement

Objective: To field-test and evaluate a prototype noise-abated, low-head, sizing screen used in metal and nonmetal minerals processing. The screen shall be installed in a processing plant and tested under actual production conditions to evaluate noise, screening performance, and durability. This is a continuation of an ongoing effort.

8. Bulldozer Noise Control

Objective: To provide a series of one-day workshops intended to assist mine personnel in selecting, fabricating, and installing noise control treatments on bulldozers which were developed previously under this program. This is a continuation on an ongoing effort.

9. Noise Control of Rubber-Lined Front End Loader Used in Surface Mines

Objective: To develop a noise control manual and a one-day workshop intended to compile and convey the previously developed work on retrofit of noise control treatments for front end loaders. The workshop and manual shall be designed to assist mining personnel in selecting, fabricating, and installing the noise control treatments. This is a continuation of an ongoing effort.

10. Impact Assessment of the the BuMines Noise Control Program on the Coal Mining Industry

Objective: To determine the extent to which BuMines-developed noise control treatments have been adopted by the industry and to determine how effective they have been in reducing the noise exposure of miners. This is a new RFP.

11. Development of a Prototype Hand-Held Rock Drill for Use in Metal and Nonmetal Mines

Objective: To develop a reduced-noise hard rock drill for use in the metal and nonmetal mining industry. The basic technology that was successful in the development of a quieter coal mine pneumatic stoper drill shall be applied. This is a new RFP.

12. Predicting Nonmetallic Screen Deck Performance

Objective: To conduct an extensive screen deck testing program in order to develop performance information and a computer model for the screening performance of nonmetallic decks. This is a continuation of an ongoing effort.

13. Integrated Approach to Noise Control for an Auger Miner

Objective: To identify dominant noise sources for auger miner systems with emphasis on continuous haulage, to develop feasible engineering noise control technology, and to perform an in-mine demonstration on an auger miner system. It is anticipated that the participation of an auger manufacturer will be required. This is a new RFP.

Industrial Hygiene (Toxic Substances)

Program Objectives: To identify and control health hazards in surface and underground mines and mineral processing plants caused by toxic and/or noxious gases and fumes, and certain particulates produced by explosives, combustible materials, and diesel engines. To develop and evaluate new instrumentation, methods, and procedures for monitoring these substances. To analyze alternative power sources that may have health advantages over existing mine diesels.

Toxic Gases And Materials

1. Determination of the Products of the Oxidative Thermal Degradation of Mine Materials

Objective: To determine the identity and quantity of gas, fume, and smoke products generated during the stages of oxidative heating of materials used in mining; i.e., preignition heating, pyrolysis devolatilization, flaming and glowing combustion, and extinguishment. This is a continuation of an ongoing effort.

2. Monitoring of Mine Air Pollutants

Objective: To develop and test engineering approaches for the control of mine air quality. To characterize exhaust gas distributions in various ventilation configurations in deadend drifts. To evaluate exhaust control hardware in simulated and real conditions. To investigate methods to identify diesel soot on respirable dust filters. This is a continuation of an ongoing effort.

3. Toxic Fumes From Explosives Tested in an Underground Mine

Objective: To determine the presence of trace toxic products such as Nitrosamines and others which may be present along with the expected products CO, NOx, SO_2, and NH_3 in the fumes from explosives fired at the working face in a mine. This is a continuation of an ongoing effort.

4. Determination of Hazards From Use of Urethane Foams Underground

Objective: To determine the toxic and flammability hazards associated with use of foams for ventilation control, sound abatement, and spray applications in underground mine operations. To develop criteria from which guidelines for safe use of urethane foams can be established. This is a new RFP.

5. Development of Gas Sensors Based on Acid Fuel Cell Technology for Use in Mining

Objective: To develop nitrogen dioxide diffusion sensors for reactive gases encountered in mines. To develop new electrode structure for rapid and stable response to gases and to implement long-term unattended operation of gas monitoring systems. This is a continuation of an ongoing effort to develop gas detectors.

Diesels

6. Development of Mobile CO_2- and CH_4-Indicating Monitors for Mining Equipment

Objective: To design, develop, fabricate, laboratory-test, and deliver mobile CO_2- and CH_4-indicating monitors for use on diesel-powered vehicles. Final versions of the monitors shall be based on previous developments and in-mine tested. This is a continuation of an ongoing effort.

7. Diesel Exhaust Measurement Apparatus

Objective: To devise and demonstrate a portable system to remove moisture and particulate matter, and reduce the temperature of diesel exhaust gas to facilitate its analysis. This is a new RFP.

8. Relationship of Underground Diesel Engine Maintenance to Emissions

Objective: To establish maintenance and equipment use patterns and relate them to rates of engine deterioration and emission levels. In-service diesel units shall be assessed with laboratory-quality emissions and diagnostic instrumentation. Fuel, coolant, and lubricating oil shall be analyzed for contamination. Catalytic reactors shall be evaluated for conversion efficiencies. This is a continuation of an ongoing effort.

9. Development of a Diesel-Hydride Mine Power Source

Objective: To evaluate a diesel-hydride power source (a diesel engine modified to burn hydrogen) for use in underground mining equipment from the standpoint of mine safety, technical feasibility, industry acceptance, and economics. To design a program leading to construction of a prototype and subsequent demonstration of such a vehicle should it be warranted. This is a continuation of an ongoing effort.

Ventilation

Program Objectives: To develop ventilation systems required to maintain a safe and healthful atmosphere conducive to efficient work output in noncoal mines.

1. Water Turbine Energy Recovery System

Objective: To design, develop, and test a fluid motor system that takes energy from the high-pressure water flowing in vertical pipelines in deep hot mines and converts this energy into useful mechanical or electrical energy. This is a new RFP.

2. Develop and Test New Designs of Underground Direct-Contact Air-Water Heat Exchangers

Objective: To develop new and improved direct-contact air-water heat exchangers for use in cooling the hot working areas of deep mines. This is a continuation of an ongoing project and will involve in-mine tests.

SAFETY

Fire and Explosion Prevention

Program Objectives: To reduce the potential for fire or explosion in mineral extraction and processing operations; to minimize the danger to people on account of fires or explosions that do occur.

Prevention Research

1. Combined Fire and Rot Treatment for Wood Mine Timber

Objective: To develop combined fire and rot retardant treatment for new and already installed mine timber. To develop methodology for treating timber in mines for existing degree of hazard; e.g., for high-, moderate-, and low-hazard locations. To prepare treated timber samples (by impregnation and coating) as needed by the Bureau of Mines (and Bureau of Mines' contractors) for testing. This is a continuation of an ongoing effort.

Suppression Research

2. Frictional Ignition Suppression by Use of Cutter-Drum-Mounted Sprays

Objective: To investigate the effectiveness of water sprays for cooling plumb-bob bits and thereby suppressing frictional ignition. This is a continuation of an ongoing effort.

3. Kinetic Studies Relevant to the Suppression of Coal Dust Explosions by Powdered Inhibitors

Objective: To study the kinetics of decomposition of various inhibitor powders under flamelike time-temperature history conditions. This is a continuation of an ongoing effort.

4. Improved Fire Protection Systems for Underground Fueling Areas

Objective: To evaluate the reliability and cost-effectiveness of various designs of improved fire protection hardware for underground fueling areas in the rugged mining environment and prepare an applications handbook. This is a continuation of an ongoing effort.

Propagation Research

5. Fire and Explosion Hazards of Oil Shale Mining and Processing

Objective: To collect sufficient data in developing and operating oil shale mines, and to conduct large-scale experiments in the field, so that the hazard due to explosion of dust, gas, or vapor and the hazards of uncontrolled fires in underground operations may be abated. This is a continuation of an ongoing effort.

6. Large-Scale Gallery Testing To Assess Hazards of Mine Timber Fires

Objective: To operate a large-scale fire gallery for evaluating the relative effectiveness of fire safety measures in metal and nonmetal mines, and to recommend improvements in mine safety and fire regulations based on results of fire trials. This is a continuation of an ongoing effort.

7. Fire Hazard Measurements of Combustible Materials in a Small-Scale Flammability Apparatus

Objective: To determine flammability hazard of mine materials under simulated fire conditions. To establish the validity of the results measured in the small-scale apparatus by comparison with results of large-scale fire tests. To recommend a version of the small-scale flammability test for MSHA's use as a tool for approval of mine materials. To determine optimum application rates of extinguishing agents. This is a continuation of an ongoing effort.

8. Fire Hazard of Equipment in Large Workings

Objective: To evaluate the potential hazard of equipment in large mine workings. This is a new RFP.

Extinguishment Research

9. The Mode of Action of Extinguishing Agents Used Against Coal Dust Explosions

Objective: To determine basic explanation for the relative extinguishing efficiency of agents used in coal mines against gas and coal dust explosions. To develop novel, state of the art extinguishing agents for gas and dust explosions. This is a continuation of an ongoing effort.

10. Remote Control of Fire Doors

Objective: To develop an economical, practical, and reliable method for remotely operating fire doors. This is a new RFP.

Detection, Instrumentation, and Alarm Research

11. Upgrade Stench Fire Warning System

Objective: Develop and in-mine test a rugged, reliable remote stench release system for large underground metal and nonmetal mines. This is a continuation of an ongoing effort.

12. High-Concentration Dust Meter

Objective: To evaluate the high-concentration dust meter through field tests. This is a continuation of an ongoing effort.

13. Improved Fire Detection Systems for Belt Haulageways

Objective: To demonstrate the feasibility of multipoint tube bundle sampling using a submicrometer particulate sensor for belt haulageway fire protection. This is a continuation of an ongoing effort.

14. Development of a Remote Readout Coal Dust Deposition Rate

Objective: To develop a commercially available, intrinsically safe remote readout coal dust deposition rate monitor. This is a continuation of an ongoing effort.

Methane Control

Program Objectives: To develop, demonstrate, and transfer technology that will prevent the formation of flammable methane-air mixtures in underground mine workings through improved ventilation and procedures for degasifying the deposit or seam in advance of and during mining. To establish correlations between the geology of the material to be mined and its gas content, and to use these to predict methane emission hazards.

Control During Mining

1. Cableless Borehole Survey Tool

Objective: To competitively procure two electronic borehole surveying units for test and evaluation. The electronic surveying instrument aids in maintaining precise control during horizonal drilling, reduces survey time, and permits routine drilling to lengths of 2,000 to 3,000 feet. The instruments shall be tested and evaluated for reliability under a wide variety of drilling conditions. This is a new RFP.

2. Improved Diffuser and Spray-Fan Systems for Ventilation of Coal Mine Working Faces

Objective: To continue research towards perfecting the spray fan system and demonstrating its effectiveness under a variety of mining conditions, particularly very gassy mines; to develop a diffuser fan-spray fan hybrid system which may offer advantages neither system alone will exhibit; to assess the effect of methane monitor placement and instrumentation lag on the indicated methane reading. This is a new RFP.

3. Methane Control in an Advancing Section of an Underground Coal Mine

Objective: To demonstrate that methane can be reduced substantially by diverting methane flows within the coalbed to long horizontal holes drilled in advance of the section, and to demonstrate the safe operation of an underground pipeline and a surface installation. This is a new RFP.

Ground Control

Program Objectives: To conceive, develop, demonstrate, and transfer technology that will prevent mine accidents attributable to falls of ground, outbursts, slope failures, and collapse of waste impoundment structures.

Premining Investigations

1. Detection of Mine Hazards and Geologic Conditions Using Electromagnetic and/or Seismic Probing from Boreholes

Objective: To field-test a seismic probe for detecting and defining the location and extent of potential mine hazards. Specifically, to demonstrate the cross-borehole automated data collection-interpretation-display system at an underground coal mine. This is a continuation of an ongoing effort.

2. Coal Mine Hazard Detection Using Synthetic Radar

Objective: To develop a useable and permissible synthetic pulse radar system that can be used in coal mines for the detection of hazards such as abandoned mines and well casings. A permissible system shall be built based on the breadboard circuit that was designed and demonstrated under contract number H0292025, "Coal Mine Hazard Detection Using Synthetic Pulse Radar." This system shall be tested in at least two coal mines for the detection of hazards. This is a new RFP.

3. Field Demonstration of Deep-Penetrating Borehole Geophysical Techniques

Objective: To develop a borehole geophysical technique to remotely sense and locate geologic fractures that are indicators of potentially hazardous zones or obstacles to future mine development. Work shall begin to establish practical field implementation of the borehole radar probing method, and then transfer the technology to industry through a series of field demonstrations at coal mine sites. This is a new RFP.

4. Development of Integrated Geophysics for Mining Problems

Objective: To develop potential effectiveness of integrated geophysical techniques for solving ground control problems in mining by evaluating the data of seismic, gravity, earth resistivity, and audio magneto telluric measurements available from previous field tests, conducting additional tests, and analyzing test results to demonstrate improved discrimination of various geologic hazards. This is a new RFP.

5. Combined Reflection and Through-Transmission Acoustic Cross-Borehole Hazard Detection System

Objective: To develop and test an acoustic system operating between boreholes over distances from several to about 330 meters for the purpose of detecting and delineating geological hazards between borehole spacings. The system shall combine the best features of both reflection and through-transmission acoustic systems. This is a continuation of an ongoing effort.

6. Improved Subsurface Control Data for High-Resolution Seismic and Acoustic Techniques

Objective: To improve the reliability of geological interpretation of high-resolution geophysical data for analysis of subsurface features representing hazards to coal mining operations. Work to be done will be data acquisition at selected field site, stratigraphic modeling of the layered subsurface, computer processing and analysis, and a final report with recommendations for high-resolution control data acquisition and processing parameters. This is a new RFP.

Selection of Mining Systems and Mine Opening Design

7. Design of Barrier Pillars To Withstand Hydrostatic Pressure and To Maintain Mountain Slope Stability

Objective: To define the likely modes of failure and the critical parameters for each failure mode for a barrier pillar constructed of in-place coal and subject to hydrostatic pressure. The influence of directional coal properties and the impact and extent of barrier deterioration with time shall be investigated. As much information as possible on the performance of coal pillars that are now used or have been used as water barriers shall be collected. This is a new RFP.

8. Determine the Effects of Abandoned Barrier and Chain Pillars on the Ground Control of Successive Longwall Panels

Objective: To determine the effects of leaving chain and barrier pillars in place between successively mined longwall panels on the ground control of active workings. Data shall be gathered from mine operators and other sources on interpanel effects of longwalling sequential panels, and shall be collected and evaluated specifically for trends in increased loading. This is a new RFP.

9. Pilot Mining Project for Assessment of Undercut-and-Fill System for Pitching Coal

Objective: To perform a small pilot mining project to test extraction rates, ground stability, ventilation, and coal transport parameters of undercut coal mining of pitching seam. Evaluation shall be made of the panel supports, stability of various anchoring methods, effectiveness of hydraulic mining and suitability of the coal product for coke production, rates of extraction obtained when mining, the effectiveness of the hydraulic coal transportation, and effectiveness of the face ventilation scheme. This is a new RFP.

10. Blasting Parameters That Affect Highwall Stability

Objective: To determine the effect on highwall stability caused by controllable blasting factors, and to study these factors by field testing. Parameters such as blasthole size, loading techniques, delay systems, burden and spacing, bench height, geology, and hole inclination shall be studied. A field manual for use by mine personnel shall be prepared. This is a new RFP.

11. Evaluation and Demonstration of Underhand Stoping To Control Rock Bursts

Objective: To demonstrate an inherently safe underhand mining method that can replace the currently used cut-and fill mining method, and to determine the rock-burst potential for the mining method. The contractor shall manage the demonstration, purchase the specialized equipment, assist the BuMines in installing instruments, gather data, and interpret results. Access to the demonstration site shall be made available to interested parties. This is a continuation of an ongoing effort.

12. Pit Slope Design Manual

Objective: To prepare a concise practical design manual by compiling, collating, and assessing the state of knowledge on pit slope design. This manual shall contain data, formulas, graphs, and tables that give quick answers to questions on various subjects involved in pit slope stability design. This is a new RFP.

Roof Support Design

13. Solidification of Large Roof Falls

Objective: To solidify roof falls to allow for safer installation of tunnel liners under the falls, and to fill voids above the falls to prevent methane accumulations. This is a new RFP.

14. High-Coal Rib and Pillar Supports

Objective: To develop and demonstrate both currently used and innovative methods of supporting high-coal ribs and pillars, and to evaluate these methods relative to their use under various mining conditions and applications. This is a new RFP.

15. Investigation of Roof Loads Induced by Mining Equipment

Objective: To determine the maximum loads induced in mine roof by general types of mining equipment such as hydraulic props, canopies on roof bolters, automatic extraction system loading platens, and similar equipment, and to determine what deleterious effects these loads have dependent on roof geology. Using field data, critical parameters shall be established for given geology and types of mining equipment used, and for optimal roof loading ranges for support members. This is a new RFP.

16. Resin Injection and Resin Doweling for Longwall Face Stabilization

Objective: To define and rank problems of roof and face stabilization in longwalls; to evaluate foreign and domestic technology in resin-injection and resin-doweling for application in U.S. mines; to select those techniques that indicate the greatest benefits per cost and are not unnecessarily hazardous, and develop testing procedures to demonstrate their effectiveness on longwall stabilization problems; and to perform and document the demonstrations and reassess the cost and safety benefits. This is a continuation of an ongoing effort.

17. Develop a Confined-Space, Drag-Jet Drill

Objective: To develop a dependable, durable, and economical 7/8-inch-diameter water jet drill with drag bit assist, having longer-than-seam-height capacity. A prototype drill shall be laboratory tested and demonstrated in the field at an underground coal mine. This is a new RFP.

18. Commercial Production Feasibility of Inorganic Cartridges

Objective: To identify and evaluate problem areas in the continuous production of water capsules and hydrocal cartridges using commercial equipment, and to evaluate the quality of these products through laboratory and field testing. This is a continuation of an ongoing effort.

Safe Support Installation and Protection at the Face

19. Remote-Controlled Bolter

Objective: To develop a simple, reliable, dependable, economical, mechanical and resin, remote-controlled roof bolt module that is able to place longer-than-seam-height bolts up to 10 feet long from a seam height of 36 to 72 inches and keep the operator outby the last permanent support. This is a continuation of an ongoing effort. Fabrication and laboratory testing shall be completed, and field testing shall begin.

20. Design, Fabricate, and Test Cement-Grouted Slurry Bolter

Objective: To design, build, and mine-test a machine that will mix and inject fast-setting inorganic grouts. The final object of the program is commercial acceptance of the bolter. Phase III (Laboratory Testing of the Complete Synthesized System) and Phase IV (Mine Testing and Final Report) shall be

completed. This will include installation of from 70 to 100 bolts to support an intersection. This is a continuation of an ongoing effort.

21. Improved Installation Equipment for Roof Trusses

Objective: To design and demonstrate improved installation equipment and practices for solid-rod roof trusses. A contract to develop equipment improvements that would provide quicker installation of roof trusses was initiated in FY79. Additional work is needed for field demonstration and perfecting improvements. This is a continuation of an ongoing effort.

22. Design and Develop Standardized Roof Bolter Controls

Objective: To extend and apply past research efforts on human engineering technology in a practical, uniform way to new roof bolting machines, and demonstrate their contributions in correcting present hazardous, accident-prone situations. The work is detailed design and fabrication. The final control configuations will be adopted in the SAE handbook. This is a continuation of an ongoing effort.

23. Development of a Hydromechanical Roof Splitter for Ground Control in Longwall Operations in Massive Roof

Objective: To develop a mechanical means to systematically break down massive roof so as to reduce the risks of roof falls and inherent hazards in the longwall operation. This shall be done by reevaluating the breaking load requirements and optimizing the breaker configuration for the splitter operating under massive roof. This is a continuation of an ongoing effort.

24. Safety Analysis of Roof Bolting Machines Used in Metal and Nonmetal Mining

Objective: To conduct field observations of machines in use in the metal and nonmetal industry and to identify equipment deficiencies and operational procedures that cause the operator to be exposed to fall of ground. Survey results shall be catalogued and made available to MSHA enforcement agencies. This is a new RFP.

25. Development of a Mechanized Scaler

Objective: To develop a mechanized scaling device for making the job of scaling safer and more effective, and to remove the operator from the dangerous area. The scaler shall be adaptable to as many of the various sizes of mine openings as possible and shall be capable of both scaling the back and ribs and breaking up any oversize rock knocked down. The contractor shall concentrate his design effort on the smaller size openings of cut-and-fill mining block caving systems, sublevel stopings, etc., rather than on large room-and-pillar-type openings. This is a continuation of an ongoing effort.

Hazard Detection and Monitoring Systems

26. Development of an Ultrasonic Rock Bolt Monitoring System

Objective: To expand the basic capabilities of the ultrasonic monitoring system to allow bolt load to be remeasured at any time after installation without load cells or torque checks. With the support of a Bureau of Mines contract (H0282032), researchers at the NASA Langley Research Center have developed an ultrasonic system capable of measuring the change in tension in a 6-foot-long roof bolt as the bolt is loaded; it is called a pulsed-phase locked-loop system. The measurement is made by sending a burst of ultrasonic energy down the bolt and receiving the reflected signal. The phase shift difference between the transmitted and received signals is linearly related to the change in stress in the bolt. This is a continuation of an ongoing effort.

27. Measurement of Installed Roof Bolt Tension

Objective: To test and evaluate the pulsed-phase locked-loop bolt tension monitor developed by NASA on mechanically anchored mine roof bolts, and to incorporate this monitor into a roof bolting machine. This is a new RFP.

28. Detection of Abandoned Workings and Cased and Uncased Oil Wells From Microwave Measurements at the Working Face

Objective: To assemble a hardened underground microwave measurement instrument and obtain certification for permissibility. This instrument shall be suitable for mounting on a longwall machine and on a room-and-pillar mining machine. Data enhancement techniques shall be strengthened with special emphasis on proving the worth of three-dimensional target identification with the near-field antenna evaluation technique under development. This technique shall be tested at a coal mine. This is a continuation of an ongoing effort.

29. Development of a Focused Electrode Array To Detect Mine Voids

Objective: To develop electrode configuration for resistivity measurement that will allow depth penetrations two to four times greater than the system currently being developed, as well as much higher resolution of the exact location of air or water-filled voids in proximity to current mining activities. This new system shall be integrated into the high-resolution earth resistivity measurement system currently being developed by the Bureau to increase its capabilities. This is a new RFP.

30. Mine Inundation Warning Systems

Objective: To determine the time for flow of impounded mine water to occur through mined-out areas under various conditions, and investigate methods for providing warning in the event of failure of a mine seal or pillar used to hold back the water. This is a new RFP.

31. Fabricate and Demonstrate Student-Designed Roof Failure Indicators

Objective: To encourage the design of roof failure indicator or monitoring equipment in graduate and undergraduate level engineering design courses. Students in engineering design courses shall be assigned the task of selecting and designing a device or system for monitoring or predicting roof failure. Selected designs shall be fabricated and laboratory tested. Satisfactory prototypes shall be field-tested. This is a new RFP.

32. Roof Bolt Tension Measuring System

Objective: To collect bolt tension data on several installation practices: how well a bolter-installed torque is maintained, what tension bleed-off values are for a particular strata, and how well bolts act as a monitoring system to indicate increasing or decreasing roof loads. This contract will provide 100 rock bolt load cell systems for MSHA inspectors to use underground to collect this bolt tension data. This is a continuation of an ongoing effort.

33. Development of a Roof Competence Tester

Objective: To develop and evaluate a hand-held instrument for accuracy and reliability in detecting cracks, fissures, delaminations, and poorly cemented and otherwise weak rock structure in coal mine roof. The instrument shall be suitable for use with all thicknesses of coalbeds and different roof compositions. This is a continuation of an ongoing effort.

34. Prototype Microseismic Roof Fall Warning System

Objective: To test the commercial prototype microseismic system in both eastern and western coal mines, make modifications indicated by the field tests, and obtain system permissibility. The commercial system shall be tested in parallel with the research systems to facilitate comparison of test results. All systems shall be upgraded as required. This is a continuation of an ongoing effort.

35. Commercially Practical Resistivity Roof Fall Warning System

Objective: To develop a commercially practical electrical resistivity roof fall warning system that can be operated reliably in an underground mine environment over long periods of time and with only minimal supervision or maintenance. It shall be capable of emitting a warning when roof falls appear imminent. This is a continuation of an ongoing effort.

36. Develop Microseismic Handbook

Objective: To develop a handbook for use by the layman for the selection, installation, interpretation, and usage of microseismic monitoring systems for prediction of catastrophic ground failures, such as rock bursts, coal bounces, and coal outbursts. This is a continuation of an ongoing effort.

Mining and Minerals Processing Waste Stability

37. Safety and Health Problems Associated With Underground Mine Waste Disposal

Objective: To identify potential safety and health hazards to underground miners that could result from the underground disposal of mine waste. This is a new RFP.

38. Disposal of Wastes Over Active Underground Mines

Objective: To determine if guidelines can be developed for safe and economical methods for the disposal of wastes over active underground coal mines. The contractor shall identify different types of mine wastes and evaluate their hazards to underground mining; evaluate underground parameters that may affect the waste pile's stability; evaluate peripheral conditions that may affect the waste disposal area; evaluate probable safety features that may be incorporated either above or below ground; and compare available waste disposal techniques for their applicability. This is a new RFP.

39. Centrifuge Model Testing of Waste Embankments

Objective: To determine safety criteria for tailings embankments by simulating field conditions using a centrifuge for modeling. Tests shall be run on a 25-foot-radius centrifuge to investigate seepage and erosion effects, foundation differentials, and other embankment construction problems. This is a continuation of an ongoing effort.

40. Satellite Monitoring of Coal Waste Embankments

Objective: To demonstrate the use of a satellite communication link with a remote data collection station located on a coal waste embankment. A suitable satellite shall be selected and negotiations undertaken to use it. A data platform shall be bought or rented and placed at the test site to connect with the instruments already in place from previous work. The present data collection station at the test site shall remain in use to check data received from the satellite and to provide additional long-term information from the instruments. Data from the two data stations shall be compared and evaluated to provide information as to the most reliable and cost-effective system. This is a new RFP.

41. Critical Parameters for Tailings Embankments

Objective: To construct probability density functions of soil parameters for tailings embankments that are representative of the major mining commodities in the United States. The contractor shall collect and categorize engineering parameters of tailings embankments for future input to slope stability models, construct probability density functions of the data, and compute the mean and variance of the data. This is a new RFP.

42. Compaction Criteria for Metal and Nonmetal Tailings

Objective: To develop data to determine compaction criteria for various metal and nonmetal wastes for both surface and underground disposal. The contractor shall determine the extent of compaction criteria available through an extensive literature search. Samples of tailings from various types of metal and nonmetal mines shall be obtained, and laboratory tests including maximum density, grain size, permeability, and static shear shall be conducted. The contractor shall determine correlations between laboratory results and actual field compaction efforts. This is a new RFP.

Industrial Hazards

Program Objectives: To limit the possibility of human error through training and worker-machine interfacing, improve equipment design and controls, detect and prevent failures of electric circuitry and hardware, provide adequate lighting in working areas, insure continuous and reliable communication between all underground and surface personnel, while providing continuous surveillance of the mine environment, and improve safety in haulage and materials-handling operations.

Human Factors

1. Design, Development, and Validation of Training System for Roof Bolt Equipment Operators

Objective: To continue the validation efforts of the roof bolter training system, extending the scope of application to include roof bolter machines of various manufacturers, and provide additional sets of copies of the final products. This is a continuation of an ongoing effort.

2. Development of Training Programs for Shaft and Slope Construction Personnel

Objective: To design, develop, implement, and validate training programs within the realm of the mine shaft construction industry that will alleviate accidents and injuries in the shaft construction industry. The training programs include task training, new miner training, and refresher courses. This is a continuation of an ongoing effort.

3. Study of Use of Personal Equipment in Low Coal

Objective: To continue work efforts in determining optimal personal equipment design for use in low coal, based on ergonomic, biomechanic, and safety considerations. Personal equipment for miners working in low coal is generally identical to that of miners working in higher seam heights. This contract is investigating personal equipment development and determining optimal designs based on environmental work parameters such as seam height and work postures. This is a continuation of an ongoing effort.

4. Biomechanical Study of Work in Low Coal

Objective: To continue with a research study of work physiology and biomechanics in low coal with the intent of generating data that can be utilized in optimal job and work station designs. Strength and work capacity measurements of miners shall be taken and correlated with physical demands of various job tasks. Recommendations for task and job redesign shall be made. This is a continuation of an ongoing effort.

5. Haulage Truck Training System

Objective: To design, develop, and validate a training program for front-end-loader and haulage truck operators. A method of conducting on-the-job training shall be formalized, and training equipment shall be developed. This is a continuation of an ongoing effort.

6. Development of Materials and Strategies for Normal and Emergency Operation of Surface Mining Equipment

Objective: To continue with the development, validation, and implementation of model training programs for emergency as well as normal operation of equipment used in surface mining operations. This is a continuation of an ongoing effort.

7. Development of Safety-Oriented Supervision and Management Training Program for the Underground Coal Mining Industry

Objective: To define accident-related work behavior in underground coal mines and to develop, implement, and validate a supervisory training program for behavior modification through the use of applied behavior management techniques. The ultimate goal is to specify and define accident-related work behaviors with sufficient precision that any resultant changes in the unsafe behavior during the research program can be replicated by other mine managers. This is a continuation of an ongoing effort.

8. Research To Determine Feasibility of Utilizing Employee Assistance Programs in the Mining Industry

Objective: To explore the feasibility of utilizing employee assistance programs to reduce accidents associated with employee personal problems. This project shall attempt to acquaint the mining industry with the concepts and procedures of reducing injuries and accidents through utilization of joint management-labor employee assistance programs. An attempt shall be made to conduct a demonstration project within one or more companies. This is a continuation of an ongoing effort.

9. Design and Evaluation of Human-Engineered Work Stations for Surface and Underground Mining Equipment

Objective: To provide the resources for technical assistance to the Human Factors Working Committee concerning concept development, preparation of workstation layout drawings, and mockup fabrication for evaluating the human factors guidelines recommended for the equipment. Based on human factors

guidelines from the committee, work station concepts will be developed and followed by detailed work station layout drawings. The most feasible designs will be evaluated through fabrications and demonstration of full-scale mock-ups. This is a continuation of an ongoing effort.

10. Evaluation and Comparison of Linear and Branching Delivery Systems

Objective: To evaluate and compare linear programing format and branching programing format, and to develop strategies and materials for certifying personnel. The program shall evaluate two media strategies for training effectiveness, develop branching program materials, and determine and develop partial electrician certification requirements. This is a continuation of an ongoing effort.

11. A Study of Coal Mine Safety

Objective: To determine the characteristics of underground coal mines that contribute to the safety of the miners. Actions that could be taken to improve safety shall be identified and ranked according to potential impact. This is a continuation of an ongoing effort.

12. Demonstration of an In-Mine Training Enhancement and Communication System, Phase II

Objective: To conduct and evaluate a training enhancement and communication demonstration project in the underground coal industry. The program shall consist of providing training for miners during time spent on the mantrip. All hardware shall be designed and fabricated, and a site-specific training program shall be developed. This is a new RFP.

13. A Cost-Benefit Approach to Coal Mine Training

Objective: To design a cost-benefit model dealing with the evaluation of training programs in the mining industry. The program shall focus on the cost of training programs relative to cost of lost-time accidents. This is a continuation of an ongoing effort.

14. Study To Determine the Comparability of Pupilographic and Electroculographic Measures in Determining Fatigue Effects in Truck Drivers

Objective: To determine through laboratory testing the comparability of pupilographic and electroculographic measures in monitoring fatigue in haulage truck drivers. This is a continuation of an ongoing effort.

15. Research Study To Determine the Applicability of New Methodologies in Mine Accident Investigations

Objective: To assess the applicability of new methodologies and procedures in determining complete and accurate antecedent and direct causes of mine accidents. This is a continuation of an ongoing effort.

16. Development of Baseline Materials for Assisting Compliance and Accident Reduction in Noncoal Industry

Objective: To develop new-miner and annual refresher instructional aids. This baseline data shall assist the noncoal industry with compliance with 30 CFR part 48. This is a continuation of an ongoing effort.

17. Development and Validation of a Training Program for Operators of Underground Noncoal Mining Equipment

Objective: To continue with development and validation of training programs that will instruct miners in the proper preshift inspection, operating, and shutdown procedures for various types of major machines and equipment utilized in underground noncoal mines. This is a continuation of an ongoing effort.

18. Needs Assessment and Training Program Development for Trainers Who Conduct Mandated Health and Safety Training

Objective: To determine the needs of industry instructors relating to techniques of instruction and subject matter knowledge and to evaluate techniques to develop and validate training program to meet those needs. This is a new RFP.

19. Biomechanical Study of Work in Underground Excluding Low Coal

Objective: To conduct a biomechanical study of work in underground noncoal with the intent of generating data that can be utilized in optimal job work station design. Strength and work capacity measurements of miners shall be taken and correlated with physical demands of various job tasks. Recommendations for task and job redesign shall be made. This is a continuation of an ongoing effort.

Electrical

20. Recommended Acceptance Criteria for Potting Materials Used in Explosion-Proof Enclosures

Objective: To investigate the problems associated with using potting materials as an explosion protection technique in coal mines. The effects of the mine environment and mechanical and electrical stresses shall be researched to aid in developing acceptance standards for potting materials used for explosion protection. This is a continuation of an ongoing effort.

21. Evaluation of High-Voltage-Proximity Warning Devices

Objective: To finalize the evaluation of high-voltage-proximity warning devices that utilize electrostatic field sensors. Feasibility studies of other sensing techniques shall also be conducted. This is a continuation of an ongoing effort.

22. Development of Tests and Criteria To Evaluate Grounding Systems

Objective: To finalize the Bureau's research program in the area of grounding in coal mines. Methods of providing grounding on dc equipment shall be prototyped and field-tested. Materials that can be used to make a composite ground

bed shall be recommended, and an experimental bed shall be installed and monitored. The merits of using boreholes as ground beds at surface mines shall be finalized. This is a continuation of an ongoing effort.

23. Field Demonstration of a DC Fault Current Limiting and Interruption System

Objective: To fabricate and in-mine demonstrate the new dc trolley line protection system. The design for the commercially viable system is based on a mercury-filled current limiting device. This is a continuation of an ongoing effort.

24. Recommendations for Quality Assurance Standards in Explosion-Proof Enclosures

Objective: To develop quality assurance standards for explosion-proof enclosures. These standards would be used by manufacturers and MSHA to ensure that the safety of the enclosures is not compromised by poor workmanship. Work on the long-term effects of the mining environment on bonding materials shall continue. This is a continuation of an ongoing effort.

25. Mine Power System Safety and Reliability Improvement

Objective: To extend present knowledge regarding minimum-level arcing currents in trailing cables, and to accumulate and analyze performance reliability data on fuses, circuit breakers, and other protective devices. Physical testing and theoretical analysis of circuit behavior in the presence of arcing faults on trailing cables shall continue. Analysis of data and further accumulation of protective device reliability data shall also continue, as shall MSHA/BuMines support on special problems. Specific items to be investigated include hazardous arcing on dc trolley lines, trolley system sectionalization, load and rectifier characteristics, and equipment maintenance practices. This is a continuation of an ongoing effort.

26. Mine Trailing Cables and Cable Splices

Objective: To conduct investigations into a variety of problem areas associated with the use of mine trailing cables and splices in underground and surface mines. New cable designs and splice designs shall be evaluated for the ability to withstand the environmental and operational stresses of mining operations. This is a continuation of an ongoing effort.

27. Improvements in DC Fuses

Objective: To improve the current-interrupting capability of dc fuses. Present fuse designs shall be evaluated and improved designs developed. This is a new RFP.

28. Assessment of High-Voltage-Explosion-Protection Techniques

Objective: To assess the merits of explosion protection techniques for high-voltage electrical equipment used in potentially explosive mine atmospheres. Explosion-proof enclosures, ventilating, and potting shall be evaluated for cost, reliability, safety, etc. This is a new RFP.

29. Requirements Study for Explosion Tests, Instrumentation, and Facilities

Objective: To review explosion testing methods, procedures, certification criteria, instrumentation, and facilities requirements to help implement the relocation and upgrading of MSHA's explosion testing gallery. Recommendations based on the latest technological advancements will be made. This is a new RFP.

30. Develop Grounding Practices for Metal and Nonmetal Mines

Objective: To continue the development of grounding practices for dredges and quarries. Ground check monitors will also be evaluated to determine whether or not they are cost beneficial for use in metal and nonmetal mines. This is a continuation of an ongoing effort.

31. Guidelines for Electrical Installation in Oil Shale Mines

Objective: To develop guidelines for the installation of electrical circuits and equipment in oil shale mines. The flammable liquids and gases present in oil shale mining present special problems relating to electrical wiring methods and equipment that will be identified and addressed. This is a new RFP.

Equipment

32. Development of ROPS Performance Criteria for Large Mining Equipment

Objective: To provide data on large machines' ROPS performance criteria by actual rollover tests of two large machines to determine if present criteria are adequate. Three ROPS for each of two large front-end loaders shall be used in the test program. The data from the tests shall be used to verify existing performance criteria or develop new criteria. This is a continuation of an ongoing effort.

33. Development of Safer Methods To Clean-Down Storage Bins

Objective: To develop an easy-to-use handbook for use by the mining industry as a guide for the proper selection and use of storage bin equipment. Improved safety equipment and practices shall also be designed, fabricated, and demonstrated. This is a continuation of an ongoing effort.

34. Design and Develop a Static Brake-Testing Facility for Testing Brake Systems on Mobile Underground Mine Equipment

Objective: To develop engineering specifications and drawings for a test facility capable of providing simulated loading conditions to the braking systems of mobile underground mining equipment. Coupled with development of testing methods and procedures, this facility will enable MSHA personnel to evaluate and certify the performance of brake systems and components. This is a new RFP.

35. Cost-Benefit and Accident Statistical Analysis of Canopies for Both Machine Type and Seam Height

Objective: To assess the practicality of extending canopy technology to low seam heights by analyzing the accident frequency of coal face equipment in underground mines. A cost-benefit analysis that considers accident histories, equipment trends and populations, and cost of accidents or injuries will be conducted and correlated to seam height. Recommendations will be made as to the benefits to be derived from further canopy development as a function of seam height. This is a new RFP.

36. Development of Limited Coverage Falling Object Protective Structures for Machines Used in Low Coal Seams

Objective: To develop conceptual designs of falling object protective structures of the noncanopy variety for use in low coal. Currently, MSHA regulations do not require cabs and canopies on machines used in a mining height of 42 inches or less. Therefore, the vast majority of machines operating in low coal have no falling object protection whatsoever. This project shall develop limited coverage falling object protective structures (roll bars, falling object protective cages, etc.) that provide lifesaving protection from roof falls, yet do not severely restrict operator vision or movement. This is a new RFP.

37. Development and Assessment of New and Existing Canopy Technology for Lower Coal Seams

Objective: To provide equipment operators with protection from roof and rib falls in low coal seams by developing a safe, human-engineered cab. A potentially acceptable canopy concept has been completed; detailed design, fabrication, and demonstration of the canopy will be part of this ongoing effort.

38. Development of Methods To Reduce Slipping and Falling Accidents Caused by Water Freezing on Foot-Bearing Surfaces

Objective: To reduce the frequency of accidents caused by workpersons slipping on iced surfaces built up on walkways, ladders, and other outside walk surfaces. This type of accident is very common at surface mineral extraction sites and aboveground processing plants that are located in cold climate areas. This is a new RFP.

39. Improved Visibility Systems for Large Haulage Vehicles

Objective: To evaluate, by means of long-term on-vehicle testing, the reliability and cost effectiveness of improved components of the improved truck driver visibility system on other classes of vehicles, such as front-end loaders and shovels. This is a continuation of an ongoing effort.

40. Extension of Low-Coal Canopy Technology To Include Coal Drill and Cutting Machines

Objective: To apply developed technology for low-coal canopies to coal drills and cutting machines. Using state of the art technology, preliminary designs and mockup fabrications of canopies for a coal drill and cutting machine shall

be completed. After approval of the preliminary designs, prototype canopies shall be fabricated and in-mine demonstrated. This is a continuation of an ongoing effort.

41. Improved Ingress and Egress Systems for Large Front-End Loaders, Large Tracked Dozer, and Loading Shovels

Objective: To evaluate the safety hazards related to ladders on large front-end loaders, large tracked dozers, and loading shovels. New designs shall then be developed and demonstrated through in-mine testing. This is a continuation of an ongoing effort.

42. Fabrication and Demonstration of Improved Operators' Cab on an Automatic-Steering Low-Coal Shuttle Car

Objective: To fabricate and demonstrate an improved split-design canopy on a low-coal shuttle car equipped with automatic steering. This effort will continue to advance the development of a semiautomatic steering system, by incorporating a high-visibility split-canopy design. The combination of these two developments onto one low coal shuttle car should overcome visibility difficulties and operator problems encountered in previous demonstrations. This is a continution of an ongoing effort.

43. A Study To Determine the Feasibility of Providing Adequate Human-Engineered Operators' Cabs in Thin Seams Through the Use of a Remotely Positioned Operator

Objective: To determine the feasibility of using a remote control miner system as an alternative to canopies in low coal seams. The effort shall be to design, build, and demonstrate a prototype or retrofit system in an active mine. This is a continuation of an ongoing effort.

44. Factory Integration of Optimized Operator Compartment for Newly Designed Shuttle Cars for Use in Low Coal Seams

Objective: To determine the feasibility of producing a practical low-coal shuttle car by designing the machine proper and its functions around an optimized operator compartment. This is a new RFP.

45. Analysis of ROPS in Service for at Least 5 Years

Objective: To determine if ROPS that have been in service for over 5 years since the MSHA requirement of July 1, 1969, are still capable of meeting SAE performance criteria. This is a new RFP.

Illumination

46. Underground Coal Mine Illumination Systems Manual

Objective: To develop a comprehensive handbook or systems manual for underground coal mine illumination. Advancements in lighting technology, available

lighting equipment, and the technical requirements of MSHA regulations shall be addressed. This is a new RFP.

47. Visibility Requirements for Face and Mobile Underground Coal Mining Equipment

Objective: To analyze work tasks and equipment designs in order to determine and generate the visual information required for safe job performance in underground coal mines. The information collected will aid engineers in the proper design and placement of underground work stations. This is a new RFP.

48. Illumination of Surface Mining Equipment

Objective: To demonstrate the potential benefits of providing illumination in surface mines. Illumination systems designed to meet the requirements of the proposed surface illumination regulations shall be fabricated and then demonstrated in mine. This is a continuation of an ongoing effort.

Nonemergency Communications

49. Data Security for In-Mine Transmission

Objective: To provide for a means of sending data throughout a mine in a secure and reliable way through both wire and wireless mediums. Standard data transmission protocols shall be reviewed and analyzed on the basis of information developed in the previous year's work. The investigation shall involve laboratory testing and theoretical analysis, concluding in a recommendation of a standard protocol for mine use. This is a continuation of an ongoing effort.

50. Methodology Development for Mine Life Safety

Objective: To apply Fault Tree Analysis techniques to the evaluation of the reliability of various life safety monitoring systems. The analysis technique developed shall be validated by applying the methodology to monitoring system case examples. This is a continuation of an ongoing effort.

51. Systems Approach to Mine Fire Safety

Objective: To develop a quantitative evaluation model to be used in rating underground fire safety monitoring equipment and techniques for compliance with CFR Title 30 requirements. The model shall be computer based and have the capability of evaluating alternative mine designs and fire protection systems. This is a continuation of an ongoing effort.

52. Buried Cable Feasibility Study, Phase II

Objective: To survey and recommend appropriate equipment to be used in the buried cable system defined in the Phase I report. This is a continuation of an ongoing effort.

53. Performance Standards for Fire Detectors

Objective: To develop an evaluation methodology and apparatus for measuring specific fire detection sensor characteristics and to develop optimum performance standards for fire sensors. Phase II of this contract shall be the detailed design of the sensor evaluation program and test apparatus. This is a continuation of an ongoing effort.

54. Communications Engineering and Administration Services for Sunshine Mine

Objective: To demonstrate a minewide selective-dial telephone system using commercially available equipment in a metal or nonmetal mine. The system has been in operation about three years. Newer, more reliable solid state intercoms shall be installed to replace existing electromechanically switched intercoms. An alternate hardwire communications link to the surface shall be completed. System expansion into the new #12 shaft area shall be begun, and hoist room phones shall be used as private lines to the surface to avoid system overload in the event of an emergency condition. This is a continuation of an ongoing effort.

55. Communications Engineering and Administration Services for Black River Mine

Objective: To demonstrate a commercially available UHF radio system and a comprehensive environmental monitoring and fire detection system in an underground limestone mine. The system allows communications with other inaccessible personnel scattered throughout the mine and will permit detection of fire against high-diesel-particulate backgrounds. A preliminary environmental data gathering system shall be field-tested to obtain data for the selection of appropriate monitoring-fire detection equipment and sensors. Installation of a comprehensive monitoring-fire detection system shall be completed. A study of the monitoring-fire detection system shall be performed concurrently with the radio study. This is a continuation of an ongoing effort.

Haulage and Materials Handling

56. Development and Utilization of the Stirling Engine for Powering Underground Mining Equipment

Objective: To demonstrate that a Stirling engine can be used to power underground mining machinery within acceptable emission levels, thereby removing the ever-hazardous trailing cable. The contractor shall assess the design changes needed to use the Stirling engine as a power source for underground mining equipment. This effort shall be directed toward the engine modifications needed for compliance with standards that specify safety requirements for mining equipment. An engine shall then be fabricated and evaluated by dynamometer testing. This is a new RFP.

57. Statistical Analysis of Wire Rope

Objective: To determine from existing wire rope test data the effect of different operating parameters on rope life and to develop an optimum statistical methodology for analysis of that data. This is a continuation of an ongoing effort.

58. Personnel Transport Vehicle Demonstration

Objective: To modify an existing transport vehicle to incorporate performance and safety concepts developed under previous Bureau programs, including improved seat construction, bumper and crash protection, redundant power brakes, and improved steering systems. This prototype vehicle shall then be demonstrated in mine. This is a new RFP.

59. Development of Track Maintenance Systems

Objective: To reduce derailments by keeping the track clean and easy to inspect. A simple, rugged, automatic track cleaner for use in underground mines shall be designed, fabricated, and in-mine demonstrated. This is a new RFP.

60. General Purpose Maintenance and Material Handling Vehicle

Objective: To modify a mining vehicle to safely perform general purpose maintenance and handling of bulky materials such as railroad rails and pipes. The vehicle shall be demonstrated in an underground coal mine. This is a continuation of an ongoing effort.

61. Tire and Rim Maintenance and Handling of Safety

Objective: To evaluate procedures and technology related to mine tire and rim maintenance and handling activities. The ultimate objective is to identify those procedures and technology that can reduce the hazards associated with this work. This is a new RFP.

62. Performance Criteria for Wire Rope Terminations

Objective: To determine the type and range of loading a particular application might impose upon a rope termination, and then develop performance criteria which a termination must meet before it could be used for that particular application. This is a new RFP.

63. Haulroad Berm, Guardrail, and Sign Design Study

Objective: To provide guidelines for the design of berms and protective guardrails for haulage roads. The sizes, shapes, strengths, and material composition of berms shall be determined for the different size classes of haulage equipment. This is the continuation of an ongoing effort.

64. Safety Evaluation of Conveyor Belt Cleaning Systems

Objective: To reduce the number of accidents associated with the cleaning of conveyor belts and areas by eliminating the need for hazardous hand labor clean-up operations. Existing conveyor belt cleaning systems shall be evaluated, and recommendations shall be made for improved effectiveness and safety. This is a new RFP.

65. Belt Conveyor Maintenance and Inspection Procedures

Objective: To prepare a conveyor maintenance manual that will define procedures and tools to be used for safe maintenance. A program for training mine personnel in the proper use of the procedures shall also be prepared. This is a new RFP.

66. Improve Equipment Design To Reduce Injuries Related To Haulage Truck Maintenance

Objective: To reduce injuries resulting from maintenance operations on mine haulage trucks by improving the design of machine components shown to be particularly hazardous to maintain. Factors to be considered may include equipment design component selection and location, materials of construction, maintenance requirements, costs associated with proposed modifications, etc. This is a new RFP.

67. Nondestructive Testing for Wire Rope Retirement

Objective: To examine and determine the applicability of new nondestructive testing techniques for wire rope retirement. This is a new RFP.

Post Disaster

Program Objectives: To develop technology that will (1) enable survivors of a mine disaster to escape from the mine or to continue to survive while awaiting rescue by providing protection against toxic and/or oxygen-deficient atmospheres, (2) aid in the location of miners trapped underground, using seismic and electromagnetic means of communication, and (3) facilitate post disaster rescue and recovery operations through surface monitoring of conditions underground, emergency communications, and mechanized transport and life support equipment for mine reentry and rescue operations.

Survival

1. Long-Term Study of the Effects of the Mining Environment on Oxygen Self-Rescuers

Objective: To subject oxygen self-rescuers to the conditions of underground mining to determine potential problems in the design and use of the equipment. This is a new RFP.

2. Physiological Responses of Coal Miners to Emergency

Objective: To quantitatively evaluate the physiologic responses of miners to the demands brought about by emergency conditions, the biophysical interaction between the miner and the prevailing environmental conditions during emergency, and physiologic responses of rescue team members, including studies of fatigue when working for longer than 2 hours, effect of weight and breathing resistance of breathing apparatus on men, effect of inhalation of hot air, and effectiveness of missions. Research products shall be reports and journal articles and input to contracts developing hardware. Training manuals shall also be written. This is a continuation of an ongoing effort.

3. Improved Oxygen Sources for Breathing Appartus

Objective: To develop solid chemicals that provide more oxygen per source to be used in future oxygen self-rescuer development. This is a continuation of an ongoing effort.

4. Handbook of Mine Rescue Equipment

Objective: To update the miner's Handbook on Mine Rescue Apparatus and Auxiliary Equipment that was published in 1961. This is a new RFP.

5. Compressed-Oxygen Self-Rescuer

Objective: To develop a 1-hour compressed-oxygen self-rescuer, comparable in size and weight to available O_2 self-rescuers. Seventy-five acceptable units shall be delivered to the Bureau of Mines for further tests and demonstrations in FY 82. This is a continuation of an ongoing effort.

6. Evaluation of New 30 CFR 11 Human Subject Test

Objective: To test current breathing apparatus to determine the ability of these devices to validate newly developed person-tests for 30 CFR 11. Contractor shall also test effect of using positive-pressure breathing apparatus with new person-tests. This is a continuation of an ongoing effort.

Communications

7. Electromagnetic Rescue System for Deep Mines

Objective: Over the past several years, the Bureau has been experimenting with VF communication sytems for detection and location of men trapped underground. The present system has been shown to be effective in a substantial number of coal mines and it is anticipated, that for mines no deeper than 330 meters, the technology is adequate. However, for deeper mines, which comprise about 10 percent in number and involve 30 percent of the work force, improvements will be necessary. The overall goal of this effort is to investigate possible alternatives, select the most promising of these options, and build and demonstrate implementing hardware. This is a continuing effort.

8. Reliability Study of Trapped Miner EM Transmitters

Objective: To conduct a test program that will determine the durability and reliability of the Bureau-developed trapped miner location system, and to submit a comprehensive final report on all work, conclusions, and recommendations. This is a new RFP.

9. Real-Time Seismic Autodetection

Objective: During the past year the Bureau has funded work to develop algorithms to enable MSHA's trapped miner seismic location system to automatically detect and locate trapped miners. However, these algorithms will not be capable of implementing real-time operation with the present system. The objective of this proposed contract is to provide real-time operation of the developed algorithms. This is a new RFP.

10. Visible Light Closed-Circuit Television Probe

Objective: To incorporate the latest state of the art electronics in a closed-circuit television borehole probe. This is a new RFP.

11. System Study of Mine Rescue Through Electromagnetic Means

Objective: To determine the various factors influencing mine rescue attempts and how the utilization of electromagnetic devices in the rescue attempts impact on these factors. This is a new RFP.

Rescue and Mine Recovery

12. Assessment of New Drilling Technology To Improve Mine Rescue Systems

Objective: To assess mine rescue drilling methods in the light of current technology. Develop new equipment and systems if warranted. This is a new RFP.

13. Low-Profile Rescue Breathing Apparatus

Objective: To build 10 preproduction units of a 2-hour, low-profile, compressed-oxygen rescue breathing apparatus (RBA) that will be suitable for use in low coal and at longwall faces. The RBA's shall be available for MSHA evaluation in early FY 82. This is a new RFP.

14. Remote-Controlled Mine Rescue and Exploratory Vehicle

Objective: To develop a remotely controlled mine rescue-exploratory vehicle capable of maneuvering through a post disaster mine environment and relaying high-quality TV pictures and selected remote-sensing readings from within the mine. This is a new RFP.

Explosives

Program Objectives: To assess the problems associated with the safe and effective use of explosives in all types of mining activity; these include fixed explosives, blasting agents, blasting devices, and blasting accessories. To conduct fundamental studies of explosive behavior and apply the results in the development of new technology. To develop new and improved test procedures as new mining methods are introduced and new types of explosives are formulated.

Blasting Agents and Other Hazardous Chemicals

1. Surface Storage Facilities for Explosives, Blasting Agents, and Other Explosives Materials

Objective: To determine the hazards associated with surface storage facilities and develop guidelines for location, construction, and protective measures. This is a new RFP.

2. Blasting Practices in Noncoal Gassy Mines

Objective: To study blasting procedures in current use in gassy noncoal operations, point out some potentially hazardous practices, and make recommendations for increased safety. This is a new RFP.

Systems Engineering

Program Objectives: To operate and maintain underground research and test facilities for use in testing and demonstrating new procedures and equipment before they are field-tested in commercial mines. To participate in processing health and safety standards.

System Analysis

1. Research To Improve Health and Safety Programs in the Mining Industry

Objective: To ascertain existing occupational illness and accident reduction methods effectively being used by mining companies and other potentially hazardous industries with the intent of developing and validating health and safety programs that can be tailored to the individual needs of companies throughout the mining industry in order to reduce accidents and injuries, including occupational diseases. To identify any health and safety problem areas within the mining industry that may surface during this study that are susceptible to solution through research or application of state of the art knowledge. This is a continuation of an ongoing effort.

2. Survey of Large-Mine-Equipment Automation To Improve Safety

Objective: To review the state of the art of automation technology (both electronic and servomechanical sciences) and delineate areas where the technology could be "ruggedized" and applied to help solve large, surface-mining-equipment safety problems. This is a new RFP.

3. Study of Face Hazards -- Roof Falls and Methane Measurements

Objective: To review and study the occurrence of face ignitions, effectiveness of methane monitors, and roof-fall-related accidents and injuries, especially those directly related to making preshift examinations, 20-minute gas checks, and gas checks prior to entry of electrical face equipment. To perform a risk analysis considering the findings above and determine under what conditions it would be less hazardous to make the methane measurements, or whether other methane measurement procedures could be followed that would provide equal or enhanced protection. This is a new RFP.

4. Computer Modeling (With Graphic Presentations) of the New Machine Work Environment Interface

Objective: To develop a computer model capable of researching the operator-machine-work environment interface. To determine the optimal design of machine parameters in order to make them compatible with human capabilities and limitation. This is a new RFP.

5. Development of a Pilot Program for Underground Mine Rescue and Emergency Utilizing Cooperative Resources

Objective: To investigate ways and means by which State facilities can be utilized in responding to mine disasters. This is a continuation of an ongoing effort.

Test Facilities

6. Wire Rope Tensile Testing Machines

Objective: To build a wire rope tensile testing machine and test hoist ropes of commonly used sizes and construction to obtain reliable data that can be used to improve retirement criteria standards, aid users in proper wire rope selection, improve MSHA inspection procedures, and improve MSHA wire rope regulations. This is a continuation of an ongoing effort.

7. Wire Rope Fatigue Testing Machine

Objective: To build a wire rope fatigue testing machine and test hoist ropes of commonly used sizes and construction to obtain reliable data that can be used to improve retirement criteria standards, aid users in proper rope selection, improve MSHA inspection procedures, and improve MSHA safety regulations. This is a continuation of an ongoing effort.

8. Lake Lynn Laboratory

Objective: To provide a new underground mine test facility to evaluate new methods and techniques for extinguishing coal dust explosions in underground mines and also construct a laboratory and office building on the surface. This is a continuation of an ongoing effort.

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